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ABSTRACT

This document presents an analysis of a normative study done to determine physical fitness norms of college age young adults. Data for this normative study were collected under the supervision of 24 coinvestigators who were affiliated with institutions distributed in all regions of the United States. The study presents the derivation of the college-age norms (including data collections methods, handing, and analyses) results of the normative study and the actual physical fitness test items (including distance runs, skinfold measurements, modified sit-ups, and flexibility-related exercises). Tables, figures, and illustrations of exercises are provided. (BA)

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Health Related Physical Fitness Test

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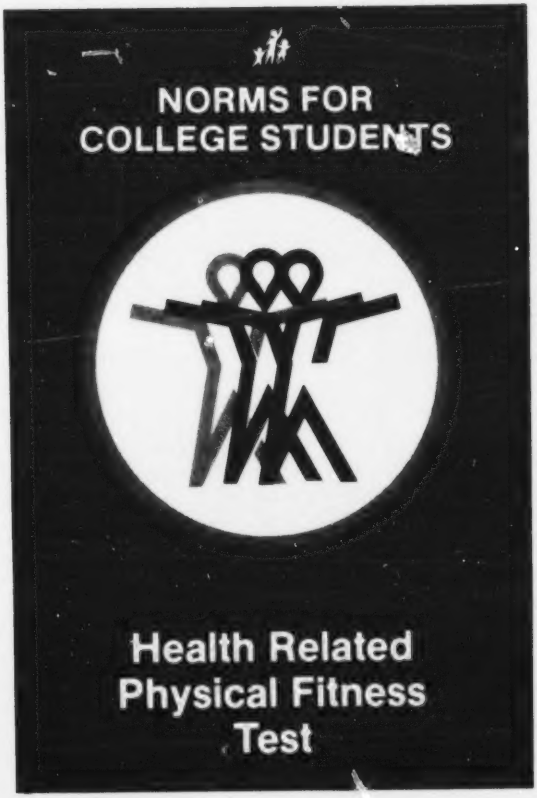

Russell R. Pate
Department of Physical Education
University of South Carolina
Columbia, South Carolina

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Acknowledgments

Many individuals contributed to the successful completion of the project presented in this booklet. The twenty-four coinvestigators who collected data are listed in Table 1 (page 4). Other important contributors were Ms. Laurie Goodyear of the University of South Carolina Human Performance Laboratory and Ms. Diana Williams of the University of South Carolina Health Sciences Computing Laboratory who assisted with statistical analyses. Appreciation is due Ms. Jackie Boland for her conscientious preparation of the manuscript and to Dr. Raymond Ciszek of the AAHPERD staff for his continuing support of this project.

R.R. Pate
1985

Contents

Introduction 1

Derivation of the College-Age Norms 3
Data Collection Methods 3
Data Handling 6
Data Analyses 6

Results of the Normative Study 7
Demographic Description of the Study Population 7
Fitness Test Data 9
Percentile Norms 10

The AAHPERD Health Related Physical Fitness Test Items 23
Distance Runs 23
Skinfolds 24
Modified Sit-Ups 28
Sit and Reach 30

References 33

List of Tables

Table

1. Coinvestigators and Institutional Affiliations 4
2. Number of Male and Female Subjects at Participating Institutions 8
3. Demographic and Physical Characteristics of the Study Population 8
4. Distribution of Subjects in Status Groups 9
5. Health Related Physical Fitness in College Age Males and Females 10
6. Health Related Physical Fitness in College Students Categorized by Sex and Age 11
7. Health Related Physical Fitness in Male College Students Categorized by Student Status 13
8. Health Related Physical Fitness in Female College Students Categorized by Student Status 13
9. Percentile Norms for the Mile Run (min:sec) for Age/Sex Groups 14

10. Percentile Norms for the Nine Minute Run (yards) for Age/Sex Groups 15
11. Percentile Norms for One Minute Timed Sit-ups for Age/Sex Groups 16
12. Percentile Norms for the Sit and Reach (cm) in Age/Sex Groups 17
13. Percentile Norms for the Sum of Triceps and Subscapular Skinfolds (mm) for Age/Sex Groups 18
14. Percentile Norms for Percent Body Fat for Age/Sex Groups 19
15. Percentile Norms for Health Related Physical Fitness Test Items for Male College Students (no age breakdown) 20
16. Percentile Norms for Health Physical Fitness Test Items for Female College Students (no age breakdown) 21

Fig.

1. Effects of sex and age on fitness test scores 12
2. Schematic drawing showing skinfold caliper pinch of skin and underlying subcutaneous fat 25
3. Subscapular and triceps skinfold measurement sites marked with grease pencil 25
4. Measurement of subscapular skinfold 26
5. Measurement of triceps skinfold 26
6. Starting position for the modified timed sit-up 29
7. Up position for the modified timed sit-up test 29
8. Test position for the sit and reach 31
9. Schematic drawing of the sit and reach measurement apparatus 32

Introduction

In 1980 AAHPERD published the *Health Related Physical Fitness Test Manual.* Publication of this booklet culminated over five years of work by several expert committees. The thrust of this effort was to reorient AAHPERD's fitness testing program to place greater emphasis on the health related components of physical fitness. The test manual published in 1980 included percentile norms for children between the ages of 5 and 17 years. The data upon which those norms were based have been described in detail in a second publication, *Health Related Physical Fitness Test Technical Manual* (AAHPERD 1984).

Following publication of the *Health Related Physical Fitness Test Manual,* in 1980 the AAHPERD Board of Governors created a Committee on Implementation and Evaluation of the Health Related Physical Fitness Test. This committee was directed to function for a three-year period to promote adoption of the new test and to evaluate its reception by professional physical educators. It was at the recommendation of this committee that the project to develop norms for young adults for the Health Related Test was conducted. The project was undertaken in the belief that the availability of appropriate norms would promote adoption of the new test at the college level.

Derivation of the College-Age Norms

Data for this normative study were collected under the supervision of twenty-four coinvestigators who were affiliated with institutions distributed in all regions of the United States. The coinvestigators and their institutional affiliations are listed in Table 1. These persons were among a total of forty-two who responded to an open solicitation for volunteers that appeared in the AAHPERD publication *Update* during the spring of 1981. Data were ultimately submitted only by the persons listed in Table 1. Since the data collectors were volunteers and since neither participating institutions nor individual subjects were randomly selected, the study population was a "convenience" sample. This procedure for identification of the study population was employed because the financial resources were not available to identify and test a national, random sample.

Data Collection Methods

Coinvestigators were provided with a detailed written description of the data collection methods. Basic descriptive data collected on all subjects included age, sex, race, height, and weight. In addition, each subject was categorized using the following classification system:

1. Subject is a student in a physical education class which is being taken to fulfill an institutional requirement (not a physical education major).
2. Subject is a student in a physical education class which is being taken on an elective basis (not a physical education major).
3. Subject is a physical education major.

Table 1. Coinvestigators and Institutional Affiliations

Investigators	Institution
Jimmie Cal	Alabama A & M
Joe Smith	Alabama, University of
Gary Albright	Arkansas State
Luke Thomas	Austin Peay State
William Vincent	California State — Northridge
Reginald Price	California State — San Bernardino
Peggy Steig	Eastern Michigan
Sandy Weeks	East Texas State
Lee Cunningham	Fitchburg State
Jim Morrow	Houston, University of
Chris Hopper	Humboldt State
Winona Vannoy	Kent State
Herb Agocs	Montana State
Marilyn Fagerstrom	Nebraska, University of
Tim Kirby	Ohio State
Michael Maksud	Oregon State
Thomas Tillman	Oregon State
Jim Disch	Rice University
James Dinucci	S.F. Austin
Wendel Gatch	S.W. Louisiana, University of
Betty Benison	Texas Christian
Tom Ward	Texas — Arlington, University of
Mike Bobo	Texas Tech
Cheryl Cohen	Western Illinois

4. Subject was randomly selected from the institution's student population.

5. Subject volunteered to participate but is not currently a student in a physical education class.

6. Other

The AAHPERD Health Related Physical Fitness Test items were administered in accordance with the procedures described in the *AAHPERD Health Related Physical Fitness Test Manual* (1980). Test items in this battery are as follows:

Fitness Component	*Test Item*
Cardiorespiratory endurance	Mile run or Nine-minute run
Low back/hamstring flexibility	Sit and reach
Abdominal muscle strength/ endurance	Bent knee sit-ups in one minute
Body composition	Triceps and subscapular skinfolds

In addition to the items listed above, skinfold thicknesses were measured at the thigh and suprailiac sites in females and at the thigh, chest and abdominal sites in males. Collection of these data allowed estimation of body density in accordance with the three skinfold procedures described by Jackson and Pollock (1978) and Jackson, Pollock and Ward (1980). Body density was transformed to percentage of body fat (% fat) using Siri's (1961) procedure. This procedure was considered acceptable since the study population was over 18 years of age and could be assumed to have attained physical maturity (Lohman 1982).

In males, skinfolds were measured at the triceps, subscapular, thigh, chest, and abdominal sites. In females, skinfolds were measured at the triceps, subscapular, thigh, and suprailiac sites. Skinfolds were measured on the right side of the body and were located as follows:

Triceps. Over the triceps muscle of the right arm halfway between the elbow and the acromion process of the scapula with the skinfold parallel to the longitudinal axis of the upper arm.

Subscapular. One cm below the inferior angle of the scapula in line with the natural cleavage lines of the skin.

Thigh. Over the quadriceps muscle group (right leg) midway between the hip and knee joints; the skinfold should run parallel to the longitudinal axis of the leg and should be located on the anterior-most aspect of the thigh.

Chest. At the midpoint between the anterior axillary fold and the nipple; the skinfold should run parallel to the border of the pectoral muscle group.

Abdomen. Two cm to the right of the navel with the skinfold running vertically (unless the skinfold is substantial and naturally runs in a horizontal direction).

Suprailium. Over the right iliac crest in the mid-axillary line; the skinfold can be aligned vertically or in parallel with the ilium.

Data Handling

Data were recorded on a standard form that was coded for entry of data into computer files. At each data collection site the data were keypunched onto 80 column IBM cards. These cards were forwarded to the principal investigator, Russell Pate, at the University of South Carolina. Data from each site were processed through an edit program designed to eliminate coding and keypunching errors. After editing, the data from the various sites were merged to form a master data set.

Data Analyses

Data analyses were designed to: (1) provide a basic demographic description of the study population, (2) describe the fitness characteristics of the population in sex categories, sex/age categories and in sex/student status categories, and (3) compute sex-specific percentile norms for the study population as a whole and for the one-year age groups between 18 and 21 years of age. Data analyses were completed using statistical packages included in the Statistical Analysis System (SAS).

Results of the Normative Study

Demographic Description of the Study Population

Table 2 lists the numbers of subjects tested at the various participating institutions. An examination of Table 2 indicates that the study population was distributed across all geographic regions of the United States. With only one exception, participating colleges were four-year institutions of higher education.

As shown in Table 3, the study population consisted of 5,158 young adults (58% females, 42% males) who averaged between 20 and 21 years of age. All subjects were college students. The racial make-up of the group was roughly comparable to that of the adult population of the United States (Bureau of the Census 1980). Mean height and weight for the group was very similar to that previously reported for American young adults (Bureau of the Census 1980).

As indicated in the data collection methods section, subjects were classified in one of six categories on the basis of the manner in which they were recruited for participation in the study. The vast majority of the subjects were students in physical education classes. (See Table 4). These subjects, who were not physical education majors, were about equally divided between those fulfilling a physical education requirement and those who were taking a class on an elective basis. Approximately 10 percent of the subjects were physical education major students.

The basic descriptive data presented in this section indicate that the study group, although not randomly selected, is reasonably representative of the population of young adult college students who take classes in physical education. This suggests that the test norms developed in this project should be applicable for use in college/university physical education classes. It is less clear that the subjects included in this study are representative of the entire

Table 2. Number of Male and Female Subjects at Participating Institutions

Institution	Males	Females
Alabama A & M	64	106
Alabama, University of	67	42
Arkansas State	149	85
Austin Peay State	133	161
California State — Northridge	47	70
California State — San Bernardino	227	209
Eastern Michigan	35	80
East Texas State	1	163
Fitchburg State	91	135
Houston, University of	43	63
Houston (J.C.)	26	85
Humboldt State	10	20
Kent State	60	81
Montana State	103	91
Nebraska, University of	10	155
Ohio State	108	95
Oregon State	184	149
Rice University	335	217
S.F. Austin	100	324
S.W. Louisiana, University of	120	100
Texas Christian	53	171
Texas — Arlington, University of	35	38
Western Illinois	176	338
TOTAL	2177	2981

Table 3. Demographic and Physical Characteristics of the Study Population

	Males	Females
Number	2177	2981
Age (years, $\bar{x} \pm SD$)	20.7 ± 2.8	20.4 ± 3.4
Race (% total)		
White	81.6	82.5
Black	11.4	12.0
Oriental	2.0	1.8
American Indian	.3	.3
Hispanic	3.0	2.3
Other	1.8	1.0
Height (in., $\bar{x} \pm SD$)	70.0 ± 3.2	64.6 ± 2.9
Weight (lbs., $\bar{x} \pm SD$)	162.7 ± 24.3	129.0 ± 19.6

Table 4. Distribution of Subjects in Status Groups

Status	Males (% total)	Females (% total)
P.E. class (required)	41.0	46.0
P.E. class (elective)	40.9	31.3
P.E. major	10.1	8.7
Random selection	1.3	.2
Volunteer (nonclass)	5.1	4.8
Other	1.6	9.0

population of young adult Americans. Therefore, the norms developed in this project may not be appropriate for application to young adults other than college students in physical education classes.

Fitness Test Data

Data for each of the fitness test items were analyzed with the subjects grouped in three different ways. First, the data were analyzed with subjects classified only on the basis of sex. Second, the data were analyzed in sub-groups formed on the basis of sex and one-year age increments (18-21 years of age). Finally, analyses were performed for sub-groups formed on the basis of sex and student status (physical education major, student taking class as a requirement or student taking class as an elective). In this section the results of these descriptive analyses are presented.

Fitness Data for Males and Females

The data for males and females are summarized in Table 5. These data reflect the typically observed sex differences in fitness test performance. Males performed at higher levels than females in the two endurance runs and sit-ups. Females outperformed males in the sit and reach. As expected, males were leaner than females.

Fitness Test Data for Age/Sex Sub-groups

Descriptions of the fitness test data for males and females in the one-year age increments between 18 and 21 are presented in Table 6. As demonstrated in Figure 1, the data, in general, were consistent across the 18-21 age range. Apparently, within the narrow age range studied, age is not an important

Table 5. Health Related Physical Fitness in College Age Males and Females ($\bar{x} \pm$ SD (N))

Test Item	Males	Females
Mile run (min:sec)	7:05 ± 1:23 (1747)	9:38 ± 1:57 (2253)
Nine-minute run (yards)	2149 ± 324 (468)	1690 ± 348 (540)
Sit-ups	44 ± 9 (2141)	36 ± 10 (2915)
Sit and reach (cm)	34 ± 8 (2131)	36 ± 7 (2908)
Sum of triceps and subscapular skinfolds (mm)	22.5 ± 9.4 (2073)	31.1 ± 11.0 (2843)
Percent body fat	10.3 ± 5.1 (2019)	23.1 ± 6.2 (2771)

determinant of performance on the test items included in the Health Related Physical Fitness Test.

Fitness Test Data for Student Status/Sex Sub-groups

Data were analyzed for sub-groups formed on the basis of sex and student status. Since nearly all the subjects fell in three status groups, only these groups were considered (physical education major, student taking class as a requirement, student taking class as an elective). Tables 7 and 8 summarize the data for the status groups for males and females, respectively.

Percentile Norms

Percentile norms (5th-99th percentile) were computed for each test item. Percentiles were determined with the subjects grouped according to sex and age (18-21 years). Also, because test scores did not vary importantly with age, percentiles were computed for the entire population grouped only by sex. Tables 9-14 present the age/sex norms. Tables 15 and 16 present the norms for males and females, regardless of age.

Table 6. Health Related Physical Fitness in College Students Categorized by Sex and Age ($\bar{x} \pm SD$ (N))

Test Item	Males				Females			
	18	19	20	21	18	19	20	21
Mile run (min:sec)	7:03 ± 1:23 (519)	7:00 ± 1:17 (303)	6:57 ± 1:17 (217)	7:05 ± 1:20 (220)	9:35 ± 1:51 (783)	9:33 ± 1:59 (478)	9:26 ± 1:47 (299)	9:23 ± 2:01 (222)
Nine-minute run (yards)	2134 ± 355 (121)	2107 ± 328 (86)	2132 ± 323 (74)	2225 ± 241 (48)	1674 ± 305 (167)	1687 ± 313 (115)	1681 ± 404 (73)	1761 ± 446 (72)
Sit-ups	45 ± 10 (624)	45 ± 10 (384)	44 ± 9 (284)	44 ± 9 (268)	36 ± 10 (983)	36 ± 9 (632)	37 ± 10 (403)	37 ± 10 (313)
Sit and reach (cm)	34 ± 8 (622)	34 ± 8 (380)	34 ± 8 (286)	33 ± 8 (266)	37 ± 7 (978)	36 ± 7 (631)	36 ± 7 (406)	36 ± 7 (314)
Sum of triceps and subscapular skinfolds (mm)	22.5 ± 8.2 (616)	22.9 ± 5.8 (365)	21.6 ± 9.0 (275)	22.1 ± 8.7 (253)	31.7 ± 10.4 (971)	30.9 ± 11.0 (620)	31.1 ± 11.6 (385)	31.1 ± 10.7 (303)
Percent body fat	10.1 ± 4.8 (606)	10.4 ± 4.9 (364)	9.7 ± 4.7 (275)	10.4 ± 4.9 (256)	23.8 ± 5.8 (959)	22.7 ± 6.3 (612)	23.0 ± 6.6 (379)	22.9 ± 6.4 (294)

Figure 1. Effects of sex and age on fitness test scores

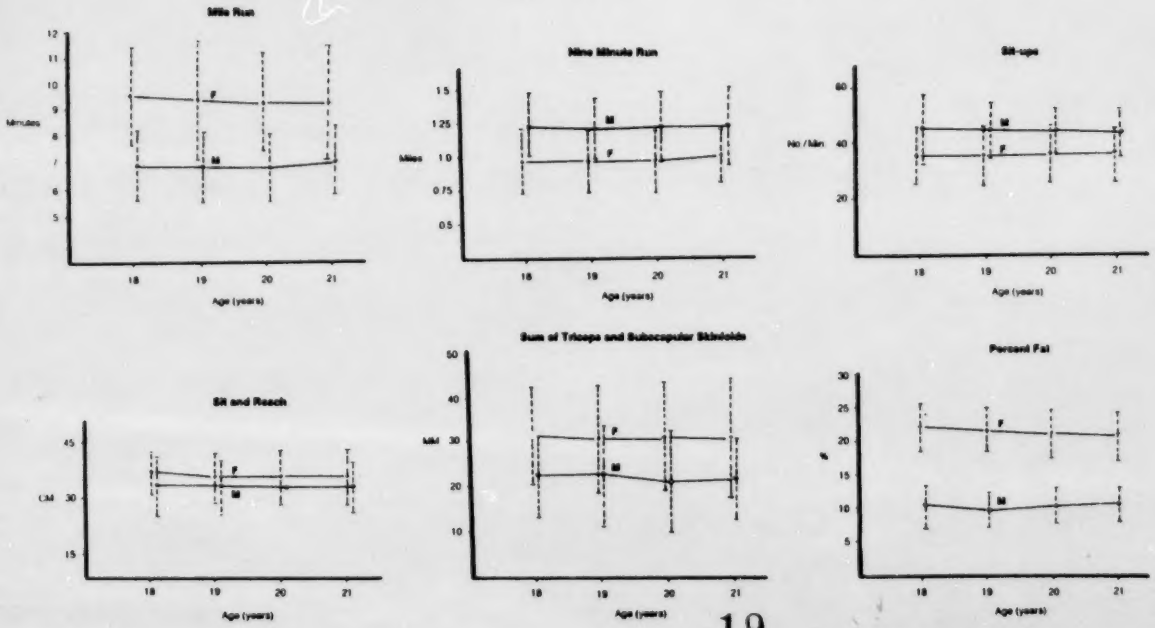

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Table 7. Health Related Physical Fitness In Male College Students Categorized by Student Status* ($\bar{x} \pm SD$ (N))

Test Item	Student Status		
	REQ	ELECT	PEM
Mile run (min:sec)	7:08 ± 1:30 (763)	7:00 ± 1:18 (649)	6:45 ± 1:11 (173)
Nine-minute run (yards)	2127 ± 362 (99)	2149 ± 309 (310)	2236 ± 360 (38)
Sit-ups	43 ± 10 (870)	45 ± 10 (867)	47 ± 8 (215)
Sit and reach (cm)	34 ± 8 (867)	33 ± 8 (859)	35 ± 8 (215)
Sum of triceps and subscapular skinfolds (mm)	22.8 ± 8.8 (837)	22.4 ± 9.7 (833)	22.7 ± 11.5 (215)
Percent body fat	10.4 ± 4.9 (801)	10.6 ± 5.1 (833)	10.5 ± 5.7 (208)

*REQ = Student in P.E. class fulfilling a requirement
ELECT = Student in P.E. class on an elective basis
PEM = Physical education major

Table 8. Health Related Physical Fitness In Female College Students Categorized by Student Status* ($\bar{x} \pm SD$ (N))

Test Item	Student Status		
	REQ	ELECT	PEM
Mile run (min:sec)	9:53 ± 1:49 (1129)	9:32 ± 1:52 (684)	8:33 ± 1:30 (158)
Nine-minute run (yards)	1565 ± 283 (110)	1680 ± 326 (321)	1906 ± 395 (92)
Sit-ups	34 ± 9 (1324)	36 ± 10 (906)	41 ± 9 (252)
Sit and reach (cm)	36 ± 7 (1327)	36 ± 7 (900)	38 ± 7 (256)
Sum of triceps and subscapular skinfolds (mm)	31.6 ± 11.2 (1296)	21.5 ± 10.6 (874)	29.2 ± 11.3 (254)
Percent body fat	23.3 ± 6.1 (1260)	23.6 ± 6.1 (855)	22.2 ± 6.3 (248)

*REQ = Student in P.E. class fulfilling a requirement
ELECT = Student in P.E. class on an elective basis
PEM = Physical education major

Table 9. Percentile Norms for the Mile Run (min:sec) for Age/Sex Groups

Percentile	Men				Women			
	18	19	20	21	18	19	20	21
99	4:57	5:00	4:33	4:38	5:33	5:27	5:16	6:26
95	5:29	5:30	5:21	5:28	7:01	6:56	7:00	7:02
90	5:43	5:42	5:40	5:47	7:28	7:22	7:21	7:21
85	5:55	5:55	5:46	6:01	7:47	7:45	7:41	7:35
80	6:05	6:04	5:59	6:09	8:01	8:00	7:59	7:47
75	6:13	6:09	6:08	6:15	8:15	8:13	8:15	8:01
70	6:21	6:15	6:15	6:22	8:31	8:25	8:30	8:09
65	6:28	6:25	6:23	6:31	8:48	8:34	8:40	8:16
60	6:35	6:32	6:30	6:39	8:59	8:52	8:56	8:30
55	6:40	6:39	6:35	6:47	9:06	9:01	9:07	8:40
50	6:48	6:45	6:43	6:53	9:23	9:13	9:20	8:57
45	6:55	6:53	6:51	6:57	9:35	9:26	9:29	9:04
40	7:03	7:01	6:56	7:02	9:49	9:41	9:43	9:24
35	7:10	7:09	7:09	7:09	10:01	10:00	9:45	9:51
30	7:17	7:15	7:19	7:20	10:16	10:07	10:10	10:02
25	7:29	7:27	7:29	7:34	10:35	10:25	10:28	10:30
20	7:45	7:45	7:41	7:49	10:50	11:00	10:45	11:00
15	8:05	8:00	7:56	8:07	11:17	11:18	11:00	11:20
10	8:33	8:30	8:30	8:29	12:00	12:00	11:30	12:13
5	9:40	9:31	9:48	9:22	13:01	13:05	12:39	12:57

21

Table 10. Percentile Norms for the Nine Minute Run Run (yards) for Age/Sex Groups

Percentile	Men				Women			
	18	19	20	21	18	19	20	21
99	3013	2820	2170	2720	2453	2255	3080	2750
95	2733	2640	2645	2640	2188	2200	2343	2524
90	2550	2530	2503	2541	2090	2090	2200	2307
85	2447	2420	2420	2457	1980	2009	2087	2203
80	2420	2365	2328	2420	1881	1927	1848	2142
75	2393	2288	2288	2391	1870	1870	1880	2068
70	2310	2255	2255	2334	1824	1824	1818	1980
65	2257	2220	2200	2307	1811	1804	1761	1906
60	2234	2200	2200	2274	1760	1760	1760	1868
55	2200	2200	2200	2255	1760	1760	1760	1775
50	2145	2185	2145	2255	1760	1750	1720	1760
45	2090	2093	2134	2212	1680	1701	1637	1760
40	2035	2028	2090	2200	1591	1650	1593	1710
35	1980	1980	2030	2200	1540	1598	1551	1650
30	1980	1962	1980	2144	1478	1584	1540	1579
25	1875	1925	1919	1994	1436	1540	1400	1491
20	1870	1870	1850	1980	1373	1466	1320	1408
15	1760	1801	1760	1967	1320	1398	1261	1320
10	1780	1760	1760	1920	1320	1320	1210	1282
5	1540	1352	1734	1777	1180	990	925	838

Table 11. Percentile Norms for One Minute Timed Sit-Ups for Age/Sex Groups

Percentile	Men				Women			
	18	19	20	21	18	19	20	21
99	70	69	65	67	61	62	63	67
95	62	60	54	61	54	52	53	54
90	57	57	55	55	49	48	49	51
85	55	55	52	54	46	45	46	47
80	53	52	52	52	44	43	44	46
75	51	50	50	50	42	41	42	45
70	50	49	49	48	40	40	41	42
65	48	48	48	47	39	39	40	40
60	47	46	47	45	38	38	38	39
55	46	45	46	44	37	37	37	37
50	45	44	45	43	35	36	36	36
45	43	43	44	42	34	35	35	35
40	42	42	43	41	33	33	34	34
35	41	41	41	41	32	32	33	33
30	40	40	40	40	31	31	31	31
25	39	39	39	39	30	30	30	30
20	37	36	37	37	29	29	30	29
15	36	35	35	36	27	27	28	26
10	34	33	33	34	25	25	25	25
5	30	30	30	31	21	22	22	21

Table 12. Percentile Norms for the Sit and Reach (cm) in Age/Sex Groups

Percentile	Men				Women			
	18	19	20	21	18	19	20	21
99	50	49	49	50	52	52	51	50
95	45	45	46	45	47	47	46	46
90	42	43	43	42	46	45	45	44
85	41	42	41	41	44	43	43	43
80	40	40	41	40	43	42	42	42
75	39	39	40	39	42	41	41	42
70	38	38	39	38	41	40	39	40
65	37	37	38	36	40	40	38	39
60	36	36	37	35	39	38	38	38
55	35	35	36	35	38	38	37	37
50	34	34	35	33	38	37	37	36
45	34	33	34	32	37	36	36	36
40	32	32	33	31	36	36	35	35
35	31	31	32	31	35	34	34	34
30	30	29	31	30	34	33	33	33
25	29	28	30	28	33	32	32	32
20	27	27	27	27	32	31	31	31
15	25	26	25	25	30	29	30	29
10	23	23	22	24	29	27	28	27
5	19	19	18	20	26	23	24	25

Table 13. Percentile Norms for the Sum of Triceps and Subscapular Skinfolds (mm) for Age/Sex Groups

Percentile	Men				Women			
	18	19	20	21	18	19	20	21
99	7	4	9	10	6	4	8	5
95	13	13	12	12	18	17	16	16
90	14	14	13	13	20	20	19	19
85	15	15	14	14	22	21	20	20
80	16	16	15	15	23	23	22	22
75	17	17	16	16	24	24	23	24
70	18	18	17	17	26	25	24	25
65	18	18	18	18	27	26	25	26
60	19	19	19	19	28	27	27	27
55	20	20	19	20	30	28	28	28
50	21	21	21	21	31	29	29	30
45	22	22	21	22	32	30	31	32
40	23	23	22	22	33	32	32	33
35	24	24	23	24	34	33	34	34
30	25	25	24	24	35	35	36	35
25	26	27	25	26	37	36	37	37
20	28	29	26	28	40	38	39	40
15	31	32	28	30	42	40	42	42
10	34	35	31	33	45	43	46	45
5	40	38	37	39	51	51	51	53

Table 14. Percentile Norms for Percent Body Fat for Age/Sex Groups

Percentile	Men				Women			
	18	19	20	21	18	19	20	21
99	3.3	2.7	2.3	1.9	8.4	7.3	7.1	5.8
95	4.1	4.0	3.6	3.7	15.1	13.2	12.4	11.9
90	4.8	4.9	4.5	4.5	16.8	15.2	15.3	15.3
85	5.6	5.6	5.1	5.3	17.7	16.6	16.7	17.1
80	5.9	6.2	5.7	6.4	18.7	17.6	17.8	17.7
75	6.5	6.9	6.4	6.7	19.7	18.4	18.6	19.1
70	7.0	7.3	6.9	7.2	20.6	19.3	19.5	19.9
65	7.5	7.8	7.3	8.1	21.4	20.3	20.3	20.6
60	8.1	8.3	7.9	8.8	22.1	21.0	21.1	21.1
55	8.5	8.9	8.5	9.4	22.6	21.5	21.9	22.1
50	8.9	9.5	8.9	9.8	23.4	22.5	22.7	22.8
45	9.5	10.1	9.6	10.3	24.2	23.4	23.5	23.5
40	10.2	10.9	10.1	10.9	24.8	23.9	24.1	24.2
35	10.9	11.6	10.6	11.8	25.6	24.8	25.1	25.2
30	11.6	12.6	11.1	12.4	26.5	25.7	26.0	25.9
25	12.6	13.3	11.8	13.4	27.5	26.6	27.1	27.3
20	14.1	14.6	12.9	14.1	28.5	27.6	28.1	28.3
15	15.2	15.5	14.5	15.3	30.0	28.9	29.4	29.6
10	16.7	17.0	16.0	16.6	31.2	30.9	31.5	30.9
5	20.5	19.1	18.5	19.6	33.4	33.3	34.7	33.5

Table 15. Percentile Norms for Health Related Physical Fitness Test Items for Male College Students (no age breakdown)

Percentile	Mile Run (min:sec)	9 Min Run (yards)	Sit-Ups	Sit and Reach (cm)	Sum of SF (mm)	Percent Fat
99	5:06	3035	68	49	10	2.9
95	5:30	2640	60	45	12	3.9
90	5:44	2530	56	43	14	4.7
85	5:57	2437	54	41	15	5.4
80	6:05	2420	52	40	15	5.9
75	6:12	2349	50	39	16	6.6
70	6:20	2293	49	38	17	7.2
65	6:29	2255	47	37	18	7.7
60	6:35	2230	46	36	19	8.3
55	6:42	2200	45	35	20	8.8
50	6:49	2200	44	34	21	9.4
45	6:56	2145	43	33	22	9.9
40	7:03	2090	42	32	23	10.7
35	7:12	2035	40	31	24	11.3
30	7:20	1980	40	30	25	12.1
25	7:32	1945	38	29	26	13.1
20	7:48	1882	37	27	28	14.4
15	8:06	1804	35	25	31	15.5
10	8:30	1760	33	23	34	17.4
5	9:47	1652	30	19	40	20.4

Table 16. Percentile Norms for Health Related Physical Fitness Test Items for Female College Students (no age breakdown)

Percentile	Mile Run (min:sec)	9 Min Run (yards)	Sit-Ups	Sit and Reach (cm)	Sum of SF (mm)	Percent Fat
99	6:04	2640	61	51	11	7.9
95	7:02	2230	53	47	17	13.7
90	7:26	2128	48	45	20	15.9
85	7:45	2020	46	43	21	17.1
80	8:01	1940	44	42	23	18.1
75	8:15	1870	42	41	24	19.0
70	8:30	1824	40	40	25	19.9
65	8:44	1807	39	39	26	20.7
60	8:58	1760	38	38	27	21.4
55	9:06	1760	37	38	28	22.1
50	9:22	1755	35	37	30	22.8
45	9:37	1682	34	36	31	23.6
40	9:51	1630	33	35	32	24.3
35	10:02	1570	31	34	34	25.1
30	10:17	1540	31	33	35	26.1
25	10:41	1460	30	32	37	27.1
20	11:00	1378	28	31	39	28.1
15	11:27	1320	27	30	41	29.4
10	12:00	1271	25	28	45	30.9
5	12:43	1101	21	24	51	33.7

The AAHPERD Health Related Physical Fitness Test Items

This section provides a brief description of the health related physical fitness test items. More detailed descriptions and discussions of these test items are provided in the *Health Related Physical Fitness Test Manual* (AAHPERD 1980) and the *Health Related Physical Fitness Test Technical Manual* (AAHPERD 1984).

Distance Runs

Purpose

The purpose of the distance runs is to measure maximal functional capacity and endurance of the cardiorespiratory system. (See Tables 9 and 10.)

Test Description

Standardized procedures and norms are provided for two optional distance run tests: the one mile run for time and the nine minute run for distance. The decision as to which of the two tests to administer should be based on facilities, equipment, time limitations, administrative considerations, and personal preference of the teacher.

One Mile Run. Subjects are instructed to run one mile in the fastest possible time. The students begin on the signal, "Ready, start." As they cross the finish line, elapsed time should be called to the participants (or to their partners). Walking is permitted, but the objective is to cover the distance in the shortest possible time.

Nine Minute Run. Subjects are instructed to run as far as possible in nine minutes. The students begin on the signal, "Ready, start." Participants continue to run until a whistle is blown at nine minutes. Walking is permitted, but the objective is to cover as much distance as possible during the nine minutes.

Equipment and Facilities

Either of the two distance run tests can be administered on a 440-yard or 400-meter track or any other flat, measured area. Examples of appropriately measured areas are the 110-yard or 100-meter straight-away, other outside fields, or an indoor court area.

Scoring

The mile and 1.5 mile runs are scored to the nearest second. The nine-minute and twelve-minute runs are scored to the nearest ten yards or ten meters.

Skinfolds

Purpose

To assess body composition (percentage of body fat).

Test Description

In a number of regions of the body, the subcutaneous adipose (fat) tissue may be lifted with the fingers to form a skinfold. The skinfold fat measure consists of a double layer of subcutaneous fat and skin the thickness of which may be measured with a skinfold fat caliper (see Figure 2). Two skinfold fat sites (triceps and subscapular) have been chosen for this test because they are easily measured and are highly correlated with total body fat.

The triceps skinfold is measured over the triceps muscle of the right arm halfway between the elbow and the acromion process of the scapula with the skinfold parallel to the longitudinal axis of the upper arm (Figure 3). The subscapular site (right side of body) is 1 cm (½ inch) below the inferior angle of the scapula in line with the natural cleavage lines of the skin.

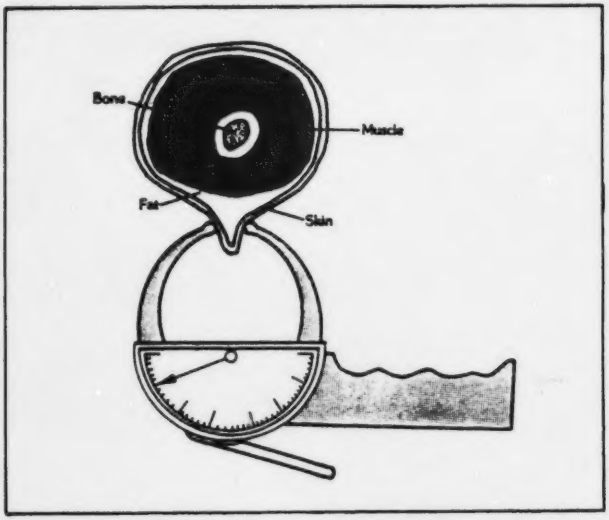
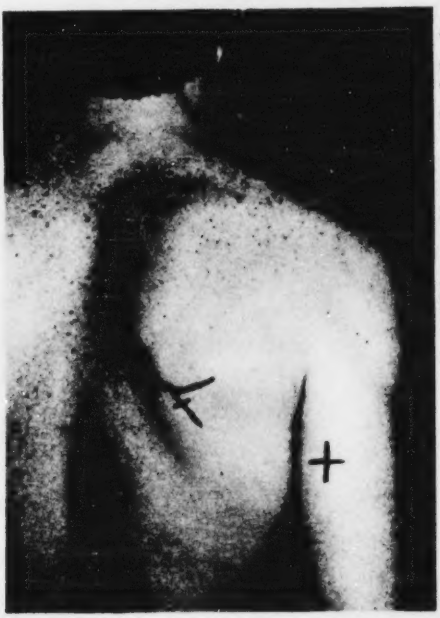


Figure 2. Schematic drawing showing skinfold caliper pinch of skin and underlying subcutaneous fat.

Figure 3. Subscapular and triceps skinfold measurement sites marked with grease pencil.



Photos courtesy of Department of Physical Education, University of South Carolina

The proper method for measuring these skinfolds is shown in Figures 4 and 5. The recommended testing procedure is:

1. Firmly grasp the skinfold between the thumb and forefinger and lift up.
2. Place the contact surfaces of the caliper 1 cm (½ inch) above or below the finger.
3. Slowly release the grip on the calipers enabling them to exert their full tension on the skinfold.
4. Read skinfold to nearest 0.5 millimeter after needle stops (1 to 2 seconds after releasing grip on caliper).

In measuring the subscapular skinfold in the female, it is recommended that the individual being tested wear a loose fitting T-shirt or similar garment. The shirt can be raised in back to allow access to the skinfold

Figure 4. Measurement of subscapular skinfold.

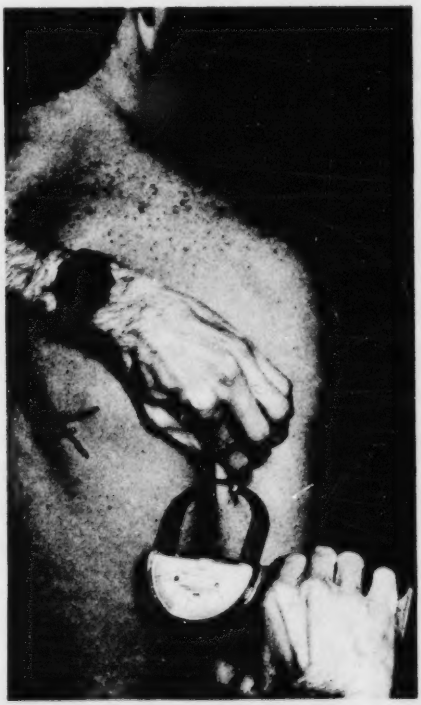


Figure 5. Measurement of triceps skinfold.

site. If the person being tested is wearing a bra, the strap need only be pushed upward 2-3 inches to allow the measurement. It might also be possible to have the female subject wear a halter or swimsuit top.

It should be noted that the protocol for the normative study described in this booklet incorporated measurement of skinfold thicknesses at several sites in addition to triceps and subscapular so that percentage of body fat could be determined (see Table 14). These additional sites are described on page 5.

Scoring

The skinfold measurement is registered on the dial of the caliper. Each measurement should be taken three consecutive times with the recorded score being the median (middle) of the three scores. To illustrate: If the three readings were 18, 15, and 16 mm, the score recorded would be 16. Each reading should be recorded to the nearest 0.5 mm. Norms are provided (Table 13) to interpret the skinfold measures. The recommended procedure is to use the sum of the two skinfolds; however, if it is possible to secure just one skinfold, the triceps should be the selected site.

Administrative Suggestions

The skinfold should be lifted by grasping the fold between the thumb and forefinger. This should be a firm grasp, but not so firm that the student experiences pain. One is cautioned not to place the calipers at the base of the skinfold. The base of the skinfold will give a reading that does not reflect the true thickness and will be too large. The correct distance from the crest is the point on the fold that true double thickness of skinfold fat exists; this is approximately midway between the crest and base of the skinfold. The caliper should be placed about 1 centimeter (slightly less than ½ inch) from the point where the skinfold is held. This is shown in Figures 4 and 5.

For testers who have not used calipers before, it is advisable to practice locating the sites and measuring them on several students. When a reproducibility from 1-2 mm or less is consistently achieved, then the tester can begin evaluating skinfolds for students. On occasion, consecutive measurements will differ by more than 2 mm especially in obese students, even with experienced testers. If this is the case, it is recommended that an additional set of three measurements be taken. Record the average of the two middle scores.

Skinfold thickness should be measured separately for each student without comment or display. Each student has the right to share or

withhold the results of this test. In all cases, interpretation of the measurements should be individually given.

For location of the triceps site, it is essential to locate the measurement at the midpoint of the back of the upper arm and avoid measuring above, below or to either side of the midpoint as described in Figure 3 and Figure 5.

Whenever possible, it is recommended that the same tester administer the skinfold fat test on the same persons on subsequent testing periods. Inter-tester error is common and may make the interpretation of subsequent measurements confusing and misleading.

Modified Sit-Ups

Purpose

The purpose of the sit-up is to evaluate abdominal muscular strength and endurance. (See Table 11.)

Test Description

To assume the starting position, the subject lies on his back with knees flexed, feet on floor, with the heels between 12 and 18 inches from the buttocks. The arms are crossed on the chest with the hands on the opposite shoulders. The feet are held by the partner to keep them in touch with the testing surface. The subject, by tightening his abdominal muscles, curls to the sitting position. Arm contact with the chest must be maintained. The chin should remain tucked on the chest. The sit-up is completed when the elbows touch the thighs. To complete the sit-up the student returns to the down position until the midback makes contact with the testing surface (Figures 6 and 7).

The timer gives the signal, "Ready,go," and the sit-up performance is started on the word "go." Performance is stopped on the word "stop." The number of correctly executed sit-ups performed in 60 seconds shall be the score. Rest between sit-ups is allowed, and the student should be aware of this before initiating the test. However, the objective is to perform as many correctly executed sit-ups as possible in the 60-second period.

Equipment and Facilities

Mats or other comfortable surfaces are recommended. A stop watch or sweep second hand from a wrist watch or clock may be used for timing.

Figure 6. Starting position for the modified timed sit-up test.

Figure 7. Up position for the modified timed sit-up test.

Scoring

Record the number of correctly executed sit-ups that are completed in 60 seconds.

Administrative Suggestions

It is important that the heels are placed a proper distance (12–18 inches) from the buttocks. Instructors may want to use a measuring stick

to ensure that the proper distance is maintained. Partners can be used to count and record each other's score, but the supervising tester must carefully observe to ensure that the sit-ups are being done correctly. The reliability and validity of the test can be improved by providing sufficient instruction and practice in the correct sit-up technique prior to testing students. Be certain that the subject's feet are in contact with the testing surface. This can be ensured by having the partner hold the feet, ankles or calves.

Sit and Reach

Purpose

The purpose of the sit and reach is to evaluate the flexibility (extensibility) of the low back and posterior thighs. (See Table 12.)

Test Description

To assume the starting position, subjects remove their shoes and sit down at the test apparatus with their knees fully extended and the feet shoulder-width apart. The feet should be flat against the end board. The arms are extended forward with the hands placed on top of each other to perform the test. The subject reaches directly forward, palms down, along the measuring scale four times and holds the position of maximum reach on the fourth trial. The position of maximum reach must be held for one second. The test apparatus and testing position are shown in Figure 8.

Equipment

The test apparatus consists of a specially constructed box with a measuring scale where 23 cm is at the level of the feet. Detailed instructions for constructing the box are provided at the end of this section.

Scoring

The score is the most distant point reached on the fourth trial measured to the nearest centimeter. The test administrator should remain close to the scale and note the most distant line touched by the fingertips of both hands. If the hands reach unevenly, the test should be readministered. The tester should place one hand on the subject's knees to ensure that they remain extended.

Figure 8. Test position for the sit and reach.

Administrative Suggestions

The reliability and validity of the test can be improved by providing sufficient time and instruction for warm-up. The warm-up should include slow sustained static stretching of the low back and posterior thighs. The test trial is repeated if (1) the hands reach out unevenly or (2) the knees are flexed during the trial. The flexing of knees can be prevented by having a monitor place his or her hands lightly across the knees.

It is recommended that an apparatus be constructed in accordance with the directions in Figure 9, so as to ensure standardization of test procedures. However, if the apparatus in Figure 9 cannot be made available, it can be improvised by using a bench with a metric ruler attached. Regardless of the specific measurement device used, it is crucial that the soles of the feet be scored as 23 centimeters since the norm table has been constructed on the basis of this assumption.

To prevent the test apparatus from sliding away from the student during the test, it should be placed against a wall or similar immovable object.

Sit and Reach Apparatus Construction Procedures

1. Using any sturdy wood or comparable construction material (¾ inch plywood seems to work well) cut the following pieces:

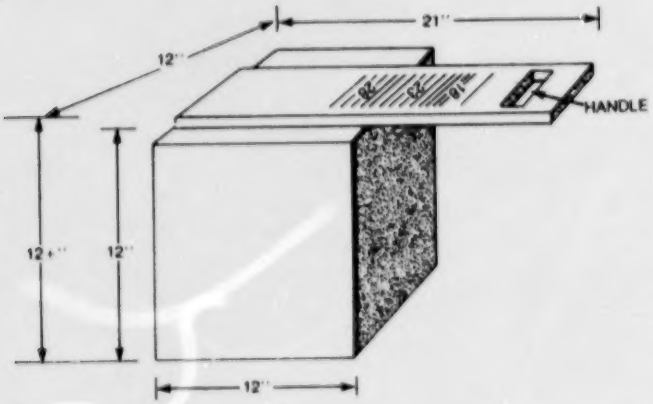


Figure 9. Schematic drawing of the sit and reach measurement apparatus.

2 pieces — 12 in x 12 in
2 pieces — 12 in x 10½ in
1 piece — 12 in x 21 in

2. Assemble the pieces using nails or screws and wood glue.
3. Inscribe the top panel with one centimeter gradations. It is crucial that the 23 centimeter line be exactly in line with the vertical panel against which the subject's feet will be placed.
4. Cover the apparatus with two coats of polyurethane sealer or shellac.
5. For convenience, a handle can be made by cutting a 1 in x 3 in hole in the top panel.
6. The measuring scale should extend from about 9 to about 50 cm.

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